

Workshop Without Walls: Upstairs Downstairs

Breakout Group 4 Note-taking

Debate #3:

Atmospheric O₂ alone is insufficient as a biosignature

What context do we need?

- First, we need the coexistence of an oxidizer and a reducer
- Supply is important
- The amount of hydrogen will influence the destruction rate of O₂
- **The flux of reductants in general will determine how long O₂ lasts (millions of years for the Earth if O₂ production stopped now)
- M dwarves will likely produce false positives - independent of planet composition?
- There are natural negative feedbacks for O₂ buildup in the atmosphere (fires, oxidation of the planetary body)
- A better biosignature would be stable, low levels of constituents like methane for long periods of time. The problem then becomes detectability.
- Photochemical production of O₂ can be estimated within a few orders of magnitude
- Are there other constituents that can be paired with O₂ as a biosignature? (Earth)
 - They would all be time dependent (i.e. CO₂)
- We should also consider seasonality → what is the range in surface temperature?

What are alternatives to O₂?

- Other life, (non oxygenic) might produce methane, H₂S
- Should we consider pigments/chlorophyll? Detection is unlikely, but worth investigating
- Different stars = different pigments
- What would have happened to Earth life without the GOE? Would the signals get stronger?
 - They might not have become facultative
 - We can estimate productivity from the abundance of organic carbon in shales?